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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/807,236	03/24/2004	Keiki Tanabe	1602-0184PUS1	4507

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EXAMINER	
NGUYEN, TU MINH	

ART UNIT	PAPER NUMBER
3748	

NOTIFICATION DATE	DELIVERY MODE
08/11/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/807,236	TANABE ET AL.	
	Examiner	Art Unit	
	TU M. NGUYEN	3748	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _21 May 2008_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1 and 3-13_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1 and 3-13_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _24 March 2004_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. An Applicant's Request for Continued Examination (RCE) filed on May 21, 2008 has been entered. Per instruction from the RCE, an Applicant's Amendment filed on April 7, 2008 has been entered. Claims 2 and 14 have been canceled; and claims 1, 3, and 4 have been amended. Overall, claims 1 and 3-13 are pending in this application.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 and 3-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al. (U.S. Patent 6,826,902) in view of Deeba et al. (U.S. Patent 6,105,365), Yang (U.S. Patent Application 2004/0261397), and Yasui et al. (U.S. Patent 6,427,438).

Re claim 1, as shown in Figures 1 and 6, Sun et al. disclose a method for estimating a NOx occlusion amount (x_{NOx}) of a NOx occlusion catalyst (36) interposed in an exhaust passage (42) in an engine (12), characterized in comprising the steps of:

- estimating (step 212) the NOx occlusion amount using a polynomial (equation (19) and the equation on lines 30-34 of column 11) reflected with a NOx occlusion characteristics (a NOx

adsorption rate (x_a)) of the NOx occlusion catalyst, wherein the polynomial for obtaining the NOx occlusion amount includes a NOx purification rate (x_d), flow rate of NOx into the catalyst, and flow rate of CO into the catalyst, and wherein these flow rates are a function of exhaust gas temperature, engine speed, and engine load, and

- correcting each coefficient of the polynomial sequentially on the basis of NOx purification rates actually measured (the coefficient c_2 on the right-hand-side of equation (19) is determined from experimental data (lines 7-8 of column 8) and is based on a NOx adsorption rate that is actually measured (see equation (4b) in column 7)).

Sun et al., however, fail to disclose that NOx occlusion amount is first obtained from an actual NOx purification calculating means that calculates an actual purification rate of the NOx catalyst based on a ratio of an actual NOx concentration at an inlet of the NOx catalyst and an actual NOx concentration at an outlet of the NOx catalyst; that the above NOx and CO flow rates are converted to coefficients that are related to exhaust gas temperature and exhaust gas flow velocity so that the polynomial is a polynomial obtained by multiplying the exhaust gas temperature and the exhaust gas flow velocity by respective coefficients; and that the method further judges that the catalyst is abnormal when an average value of the each coefficient in a predetermined period is deviated from a predetermined range.

As shown in Figure 2, Deeba et al. disclose an apparatus for purifying NOx emission from an internal combustion engine, comprising a NOx occlusion catalyst (42) located at an exhaust path 24) of an engine (10). Deeba et al. teach that it is conventional in the art to determine (in expression (1) in column 7) an NOx occlusion amount by the catalyst from an actual NOx purification calculating means that calculates an actual purification rate (η) of the

NOx catalyst based on a ratio of an actual NOx concentration (EONOx) at an inlet of the NOx catalyst and an actual NOx concentration (TPNOx) at an outlet of the NOx catalyst (see expression (1') in column 9 and lines 40-49 of column 9). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Deeba et al. in the method of Sun et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to accurately determine the NOx occlusion amount in a NOx catalyst.

As shown in Figure 1a, Yang discloses a NOx control apparatus for an internal combustion engine comprising a NOx occlusion catalyst (105). As indicated in paragraphs 0016-0021 and 0024-0028, Yang teaches that it is conventional in the art to estimate an NOx flow rate from the engine and a CO flow rate (ratio of CO and NOx) based on the parameters such as engine or exhaust gas temperature and exhaust gas space velocity; so that an NOx occlusion amount in the catalyst is characterized by these parameters. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Yang in the modified method of Sun et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art.

As shown in Figures 1, 3-7, 12, and 15, Yasui et al. disclose a method for evaluating deterioration state of a catalytic converter (3), comprising a step of modeling an output of a downstream air-fuel ratio sensor (5) into a polynomial function (see expression (1) in column 14). As indicated in the Abstract, Figures 12 and 15, Yasui et al. teach that it is conventional in the art to compute the evaluating parameters AGDP1, AGDP2, and AGDP3 based on the identified parameters a1, b1, and c1 of the polynomial function; wherein the evaluating

parameters are compared with their respective threshold values in order to determine a deterioration state of the catalytic converter. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Yasui et al. in the modified method of Sun et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to accurately assess a working condition of a catalytic converter.

Re claim 3, the modified method of Sun et al. is characterized in that the polynomial is expressed by an equation that includes coefficients multiplying with at least one of NOx purification rate, exhaust gas temperature, and exhaust gas space velocity.

Re claim 4, the modified method of Sun et al. is characterized in that the correcting step comprises, in an occasion of correcting the coefficient sequentially:

- estimating the (N+1)-th NOx purification rate on the basis of the N-th (N is a natural number) NOx occlusion amount obtained from the polynomial (see Figure 2 where a release rate and a storage rate of oxygen is sequentially determined based on a relatively oxygen level), and

- correcting each coefficient such that the estimated (N+1)-th NOx purification rate becomes the NOx purification rate actually measured.

Re claim 5, it is well known to one with ordinary skill in the art that the modified method of Sun et al. is further characterized in that the coefficient is corrected by using the method of least square.

Re claim 6, the modified method of Sun et al. is characterized in that a NOx discharging amount in the NOx occlusion catalyst is calculated according to the following equation:

NOx discharging amount = ∫ (reducing agent concentration at catalyst inlet x reducing agent utilization rate – a constant x oxygen concentration in catalyst inlet) x exhaust gas flow rate (See equation (4b) and lines 54-67 of column 8).

Re claim 7, in the modified method of Sun et al., a reducing agent utilization rate (see lines 50-67 of column 7) is characterized in a map (see Figure 2). They, however, fail to disclose that the reducing agent utilization rate is further set on the basis of exhaust gas temperature and exhaust gas flow velocity.

As shown in Figure 1a, Yang discloses a NOx control apparatus for an internal combustion engine comprising a NOx occlusion catalyst (105). As indicated in paragraphs 0024-0028, Yang teaches that it is conventional in the art to estimate an NOx reduced or desorption rate based on the parameters such as engine or exhaust gas temperature and exhaust gas space velocity; so that a reducing agent utilization rate by the catalyst is characterized by these parameters. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Yang in the modified method of Sun et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art.

Re claim 8, the modified method of Sun et al. is characterized in that:

- the reducing agent utilization rate is estimated using a polynomial (see equation 4(b)) which is reflected with a NOx discharging characteristics of the NOx occlusion catalyst, and

- the coefficients of the polynomial are sequentially corrected on the basis of the concentration of reducing agent.

Re claim 9, the modified method of Sun et al. is characterized in that:

- the polynomial for obtaining the reducing agent utilization rate includes a catalyst inlet reducing agent concentration (line 6 of column 6),

- an exhaust gas temperature and an exhaust gas flow velocity (see paragraphs 0024-0028 in Yang), and

- the polynomial is a polynomial obtained by multiplying the catalyst inlet reducing agent concentration, the exhaust gas temperature, and the exhaust gas flow velocity by respective coefficients.

Re claim 10, the modified method of Sun et al. is characterized in that the polynomial for the reducing agent utilization rate is expressed by an equation that includes coefficients multiplying with at least one of a catalyst inlet reducing agent concentration, exhaust gas temperature, and exhaust gas space velocity.

Re claim 11, the modified method of Sun et al. is characterized in that:

- the engine is constituted such that switching can be performed between a lean operation where an exhaust gas air-fuel ratio is lean and a rich operation where the exhaust gas air-fuel ratio is rich (lines 38-41 of column 3), and

- the coefficients of the polynomial are held during the rich operation, and when a difference between the NOx purification rate obtained by using the held coefficients at a starting time of the lean operation and the NOx purification rate actually measured is equal to or more than a threshold value, the NOx occlusion amount is corrected (coefficients c_1 and c_2 are based on experimental data and are corrected based on a measured changed of NOx adsorption or desorption rates).

Re claim 12, the modified method of Sun et al. is characterized in that the NOx occlusion amount is corrected, when a difference between an actually measured value of the NOx purification rate (x_a, x_d) at the starting time of the lean operation of the engine and an estimated value thereof is equal to or more than a threshold value (the coefficients c_1 and c_2 are based on experimental data and are corrected based on a measured changed of NOx adsorption or desorption rates so that an estimated or predicted NOx purification rate (x_a, x_d) is within a predetermined range with a measured value).

Re claim 13, the modified method of Sun et al. is characterized in that the NOx occlusion amount is corrected based upon a judgment that a NOx occlusion amount calculated at the starting time of the lean operation is incorrect when a difference between the NOx purification rate (x_a, x_d) estimated by the polynomial and the NOx purification rate obtained by actual measurement immediately after switching is performed from the rich operation of the engine to the lean operation thereof is equal to or more than a predetermined value.

Response to Arguments

4. Applicant's arguments with respect to the references applied in the previous Office Action have been fully considered but they are moot in view of the new ground(s) of rejection.

Prior Art

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure and consists of two patents: Akazaki et al. (U.S. Patent 5,937,638) and Makki et al. (U.S. Patent 6,879,906) further disclose a state of the art.

Communication

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (571) 272-4862.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Tu M. Nguyen/

TMN

August 1, 2008

Tu M. Nguyen

Primary Examiner

Art Unit 3748